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Annual Report 1986/1987

Canada  Ontario 

Canada-Ontario Agreement Respecting Great Lakes Water Quality
L'Accord Canada-Ontario relatif à la qualité de l'eau dans les Grand Lacs



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LETTER OF TRANSMITTAL

June 1988

The Honourable David Peterson
Minister, Environment Canada

1986/87 ANNUAL REPORT

The Honourable David Peterson
Minister, Environment Canada

CANADA - ONTARIO AGREEMENT

The Honourable David Peterson
Minister, Environment Canada

RESPECTING GREAT LAKES WATER QUALITY

The Honourable Vincent Blaney
Minister, Ontario Ministry of Natural Resources

The Honourable David Peterson
Premier of Ontario and
Minister, Ontario Ministry of Intergovernmental Affairs

The Honourable Jean Vézina
Minister, Agriculture Canada

The Honourable Jack Layton
Minister, Ontario Ministry of Agriculture and Food

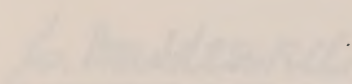
Enclaves:

JULY 1988

In accordance with Section 1 of Schedule 9 of the
Canada-Ontario Agreement Respecting Great Lakes Water
Quality, signed in Toronto, Ontario, we submit the Annual
Report under this Agreement for the fiscal year 1986-87.

GOVERNMENT OF CANADA




J. B. McEwen
Minister, Environment
Canada

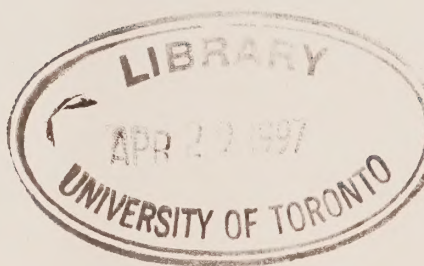

J. A. Miller
Minister, Ontario Ministry of the Environment

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1988-1989
Annual Report

1988-1989 ANNUAL REPORT
CANADA - ONTARIO AGREEMENT
RESPECTING GREAT LAKES WATER QUALITY

WATER QUALITY



1988-1989

LETTER OF TRANSMITTAL

June 1988

The Honourable Tom McMillan
Minister, Environment Canada

The Honourable Jim Bradley
Minister, Ontario Ministry of the Environment

The Honourable Tom Siddon
Minister, Fisheries and Oceans

The Honourable Vincent Kerrio
Minister, Ontario Ministry of Natural Resources

The Honourable David Peterson
Premier of Ontario and
Minister, Ontario Ministry of Intergovernmental Affairs

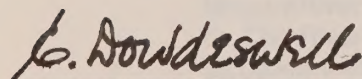
The Honourable John Wise
Minister, Agriculture Canada

The Honourable Jack Riddell
Minister, Ontario Ministry of Agriculture and Food

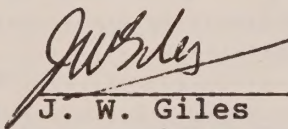
Gentlemen:

In accordance with Section 2.(v) of Schedule F of the Canada-Ontario Agreement Respecting Great Lakes Water Quality, signed on March 6, 1986, we submit the Annual Report under this Agreement for the fiscal year 1986-87.

GOVERNMENT OF CANADA PROVINCE OF ONTARIO



E. Dowdeswell
Co-chairperson
Environment Canada



J. W. Giles
Co-chairperson
Ontario Ministry of the Environment

June 1994

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SECTION I: BACKGROUND

In the early 1970s, public concern and scientific study focused on the serious pollution problems plaguing the Great Lakes. Closed beaches, fish kills, massive algal blooms and odour problems were the more obvious signs that immediate and comprehensive actions were required to restore and maintain the integrity of the lakes.

To initiate these actions, the Governments of Canada and the United States entered into a pollution abatement agreement.

The Canada - United States Great Lakes Water Quality Agreement

Many of the pollution problems in the early seventies were associated with high nutrient levels in the water. This condition, called eutrophication, results from excessive loadings of phosphorus. In April 1972 Canada and the United States signed the Great Lakes Water Quality Agreement requiring both Federal Governments, the eight Great Lakes States and the Province of Ontario to reduce phosphorus loads to the Great Lakes.

In response, the respective governments launched massive cleanup programs. Major municipal programs with expenditures totalling over eight billion dollars, industrial controls and phosphate limitations on detergents did produce a reduction, and in some areas a reversal, of eutrophication. Nuisance algal blooms are no longer a common occurrence.

Later in the decade, scientists using advanced technology and detection methods identified a new environmental challenge -- toxic substances. These substances affect living things in a manner unlike the more traditional pollutants. Even in low concentrations, they can pose a risk to aquatic organisms, wildlife and humans. Some, the persistent toxic substances, do not break down or do so only very slowly. As well they do not pass through the body of the organism but instead are stored in fat and accumulate.

To address the challenge that toxic substances presented, Canada and the United States revised their Agreement. The 1978 Great Lakes Water Quality Agreement provided for a more explicit attack on toxic substance contamination and the control of non-point sources. It expressed, for the first time, the principles of virtual elimination and zero discharge of persistent toxic substances.

These principles are significant components of a broader, more comprehensive approach to pollution control introduced by the revised Agreement. The governments recognized that the complexities and interrelationships revealed by the problem of toxic substances demanded an ecosystem approach to the management and study of the Great Lakes Basin. In the Purpose of the Agreement, they stated their intent "...to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem".

To fulfill this purpose, the Agreement provides both General and Specific Objectives and Annexes. The General Objectives state the broad goals of the Agreement with respect to water quality and the control of pollution. The Specific Objectives set out specific limits, which, when met will ensure the protection of the most sensitive uses in all waters. Annexes in the Agreement provide the guidelines for actions to be taken to meet the Objectives.

The Canada - Ontario Agreement

The Governments of Canada and Ontario recognized that they shared in the responsibility to maintain the aquatic ecosystem of the Great Lakes basin. They also realized the value in adopting common objectives, and developing and implementing cooperative programs. The framework for this cooperation is provided by the Canada-Ontario Agreement Respecting Great Lakes Water Quality (COA).

Canada and Ontario first entered into agreement in 1971 to promote the signing of the Canada-United States Agreement. Since then, COA has served as the focal point for coordinating federal and provincial efforts in meeting Canada's international commitments. COA was revised in 1976, 1982, and 1986.

Work under COA is coordinated by several committees -- each of which is responsible for an area of activity specified under the Agreement -- and a Board of Review. The committees bring together senior members of federal departments and provincial ministries. In these forums, specific problems are identified, work plans are developed and progress is monitored. Members then inform their respective ministries and departments on the activities of other areas and coordinate plans within their areas to meet the commitments made under the Agreement.

Committee findings are provided to the Board of Review. The Board of Review uses this information to assess the adequacy of current programs, and develop and recommend new policies and programs to resolve existing and emerging problems.

This process ensures that all efforts to protect the environment are integrated. Integration, in turn, leads to effective delivery of environmental protection programs while minimizing over-all government expenditures.

The International Joint Commission

To develop candid assessments of the nature and extent of Great Lakes pollution, the International Joint Commission (IJC) is empowered under the Canada - United States Agreement to report to governments and to the public on progress made in implementing the Agreement.

The federal and provincial governments, therefore, provide the Commission with the data and results gained through their efforts under COA. The Commission then independently collates, analyzes, and reports comparable surveillance and related information gathered by all governments under the aegis of the Canada - United States Agreement. The Commission makes recommendations based on these extensive data. The recommendations help ensure the Agreement remains responsive to existing and emerging environmental problems facing the Great Lakes.

SECTION II: OVERVIEW

The COA Board of Review

The Board of Review guides the implementation of the Canada-Ontario Agreement. To fulfill this role, the Board consults with the COA Committees, monitors programs and reports to the governments on the performance of these programs. The Board also provides the International Joint Commission with information on programs and scientific/technical data.

The Board of Review consists of 10 members -- five each from the federal and provincial governments. The members as of March 31, 1987 were:

Government of Canada

E. Dowdeswell/ J. D. Kingham
Regional Director General
Conservation & Protection
Environment Canada

E. T. Wagner
Regional Director
Inland Waters Directorate
Environment Canada

R. M. McMullen
Regional Director
Central & Arctic Region
Freshwater Institute
Fisheries & Oceans Canada

G. Gorrell
Regional Director
Agriculture Development Branch
Agriculture Canada

Government of Ontario

J. W. Giles
Associate Deputy Minister
Intergovernmental Relations &
Strategic Projects Division
Ministry of the Environment

W. A. Steggles
Environmental & Technical
Advisor
Intergovernmental Relations
Ministry of the Environment

G. R. Whitney
Director
Fisheries Branch
Ministry of Natural Resources

V. I. D. Spencer
Director
Soil & Water Management Branch
Ministry of Agriculture & Food

As of March 31, 1987, the Board of Review had two vacancies: one member from Environment Canada and one member from the Ontario Ministry of the Environment.

Canada - Ontario Agreement Activities

In the 1986/87 fiscal year, the Board of Review monitored and reported on activities in six areas. A brief summary is provided below. Details on specific activities appear in Sections IV - IX of this report.

Sewerage Facilities Construction Program

Construction and upgrading of sewage treatment facilities in Ontario were continued in this year. The goal of the program is to reduce the phosphorus discharge from plants (with discharges greater than 1 MGD) to 1 mg of phosphorus/litre of discharge.

The 1982 COA stipulated a one-time federal contribution of \$65 million to Ontario to complete the program. As of March 1987, \$62,917,746 had been expended.

In 1986/87, the federal contribution totalled \$4,583,115. These monies were spent as follows: \$3,099,142 for sewage treatment plants; \$626,176 for sewage pumping stations; and \$857,797 for sewers.

The program will be completed by March 31, 1988.

Nearshore Surveillance

For nearshore surveillance, research and other activities, Ontario and Canada increased funding in 1986/87 to \$3.2 million, shared equally. Details of the surveillance activities are provided in this report in Section IV.

Phosphorus Reductions

Under successive Agreements, Canada and Ontario have reduced phosphorus inputs to the lakes primarily through phosphorus removal at sewage treatment plants and by limitation of the phosphorus content of laundry detergents.

In 1984/85 a federal-provincial task force developed a phosphorus management plan for the lower Great Lakes. The purpose of the plan is to reduce the total loadings of phosphorus discharged to Lake Erie by 300 metric tonnes per year of which 200 metric tonnes is attributed to agricultural sources.

In 1986, plan implementation was carried out further through the signing of an Agreement on Soil and Water Quality Enhancement (SWEEP) aimed at the reduction of agricultural sources. Agreement programs seek improvement of soil productivity by reducing soil erosion and phosphorus runoff into streams, rivers, and the lakes.

The coordinated \$30 million program is led by Agriculture Canada and the Ontario Ministry of Agriculture and Food and supported by Environment Canada and the Ontario Ministry of the Environment. The Ministry of Agriculture and Food is responsible for local demonstrations, technical assistance and soil conservation management incentives. Agriculture Canada will provide technology assessments, conservation information, socio-economic evaluation and pilot demonstration watersheds.

Remedial Action Plans

Since 1973, the International Joint Commission has compiled a list of "Areas of Concern" where water quality objectives have been exceeded and remedial measures are required to restore beneficial uses. Currently, there are 17 Areas of Concern in Ontario. These will be studied and restored through the development and implementation of Remedial Action Plans (RAPs). The federal and provincial governments, under COA, are taking a lead role in the development of RAPs. (Details are provided in Section IV of this report.)

Each RAP will: define the problem and the extent of area affected; identify the uses impaired; locate the causes of problems and pollution sources; develop remedial measures to address these problems; determine a schedule for implementation and completion of remedial measures; designate agencies responsible for remedial measures and institute mechanisms for monitoring remedial measures. A surveillance and monitoring program will also be included in each plan to measure the effectiveness of the remedial program and to track and confirm restoration of the area.

In most areas, efforts to date have focussed on gathering preliminary data and initiating public consultation. Public consultation plays a significant role in the development of a RAP program. It serves to inform and stimulate interest in local water quality issues and provides a basis for generating broad community support for RAP implementation. Input is obtained from the local stakeholders (municipalities, industries, universities, interest groups, general public) to better define use goals affected by water quality and to develop remedial options for restoring water uses.

Upper Great Lakes Connecting Channels (UGLCC) Study

In July, 1984, a three-year joint Canada-United States Upper Great Lakes Connecting Channels (UGLCC) Study was announced. The study is a cooperative effort among Canada, the United States, Michigan and Ontario to document the environmental conditions of the St. Clair, Detroit and St. Marys Rivers together with sources of pollution with recommendations to remedy them.

The three year investigation is a complete study of direct and indirect sources of water pollution throughout the drainage system. The results of some 200 investigations by the several agencies involved will be synthesized into the overall report to be completed in 1988. It is expected that a course of action will be recommended to reduce the pollution sources or reverse the causes of contamination, to improve the health of the system and to monitor the effectiveness of clean-up programs. This information will be used in the development of Remedial Action Plans for the St. Clair, Detroit and St. Marys Rivers.

Niagara River and Lake Ontario Toxics Management Plans

In October 1986, Environment Canada, Ontario Ministry of the Environment, New York Department of Environmental Conservation and the U. S. Environmental Protection Agency agreed to a Niagara River Toxics Management Plan. The Plan directs the activities of the four governments in their efforts to reduce loadings of persistent toxic chemicals to the Niagara River in accordance with a timetable and a set of specific activities.

The Plan calls for improved river monitoring, increased measurement of discharges from point and non-point sources as a basis for enforcement actions, the collection of information about chemicals of concern and a commitment to citizen participation in the evolution of the Plan.

On February 3, 1987 a Declaration of Intent was signed by the heads of the four agencies. Among other matters, the Declaration commits the agencies to achieving a 50 per cent reduction of persistent toxic chemicals by 1996, as a first step towards the goal of virtual elimination of persistent toxic substances.

The parties also agreed to consider excavation at waste management sites. In addition, they agreed that negotiations commence on a Toxics Management Plan for Lake Ontario to be completed by January 1988.

SECTION III: CANADA-ONTARIO COMMITTEES

Coordinating Committee

Under the direction of the Board of Review, the Coordinating Committee coordinates the activities of all COA Committees to fulfill requirements and commitments of the Agreement. It reports jointly with the other committees on significant findings and problems which may affect the governments' ability to meet their commitment to the Canada - United States Great Lakes Water Quality Agreement. The Coordinating Committee also briefs the COA Board of Review on initiatives proposed by the International Joint Commission which will influence the federal and provincial programs and policies pertaining to Great Lakes water quality.

The Coordinating Committee consists of fourteen members, including the co-chairmen of the six other COA committees. The Committee is co-chaired by Environment Canada and the Ontario Ministry of the Environment.

Surveillance Committee

The objective of surveillance and monitoring is to assess the state of and trends in the overall health of the Great Lakes aquatic ecosystem through the measurement of physical, chemical and biological parameters. This includes the assessment of polluting and toxic substances.

To meet this objective, the Surveillance Committee coordinates the surveillance activities of Canada and Ontario. The Committee reviews objectives, scope, and expected output of surveillance programs proposed by the agencies of both governments. Recommendations are made then by the Committee for approval and funding under COA. Reports are also made on the progress achieved by the programs and new problems and findings identified by surveillance.

The Surveillance Committee is co-chaired by the Federal and Provincial members responsible for Great Lakes surveillance: from Environment Canada, the Manager of the Surveillance Program, Inland Waters Directorate; from Ontario Ministry of the Environment, the Manager of the Great Lakes Section, Water Resources Branch. Other members of the Committee represent federal department and ministry branches directly involved in Great Lakes water quality and monitoring.

Toxic Substances Committee

The Toxic Substances Committee provides a forum for the exchange of information among scientists and managers involved in the detection, quantification and control of toxic and hazardous polluting substances.

Through this exchange, the Committee can identify priority areas and issues of concern and can also evaluate the federal and provincial programs that address toxic pollutants. This information is then passed to the Coordinating Committee.

To ensure a wide cross-section of expertise, the Toxic Substances Committee members are drawn from all agencies who regulate toxic substances.

Pollution Controls Committee

The Pollution Controls Committee monitors a wide variety of research and control programs. These include programs that address: pollution from municipal and industrial sources; eutrophication; pollution from agriculture, forestry and other land use; pollution from shipping, and dredging; and contingency planning.

The Committee reports immediately on significant findings and concerns identified by research. It also provides an annual report to the Board of Review on the progress made under the program.

The Pollution Controls Committee is co-chaired by the Pollution Control Division Manager of the Federal Environmental Protection Service (Ontario Region) and by the Assistant Director of the Provincial Water Resources Branch from the Ontario Ministry of the Environment.

Polluted Sediment Committee

The Polluted Sediment Committee is responsible for developing the Polluted Sediment Program and identifying the specific tasks required to fulfill the program. The Committee ensures that adequate scientific and technical input and review is integrated into the program. It also monitors the progress made under various components of the program to ensure consistent conclusions and recommendations are made by federal and provincial agencies.

The Polluted Sediment Committee is co-chaired by the Chief, Sediment Quality Assessment and Biomonitoring, of the Aquatic Contaminants Section, Ontario Ministry of the Environment and the Senior Environmental Design Officer, Federal Environmental Protection Service, Environment Canada. Support to the Committee is provided from all agencies involved with polluted sediments on an as-needed basis.

Environmental Monitoring and Modelling Committee

The Environmental Monitoring and Modelling Committee was established to assess the effectiveness of federal and provincial programs to reduce phosphorus loadings to the Great Lakes. To meet this mandate, the Committee is involved in the following activities: obtaining and interpreting phosphorus loading data for major river tributaries to Lake Erie; conducting phosphorus load and water quantity monitoring activities on the pilot demonstration watershed studies instituted under the Agreement on Soil and Water Quality Enhancement (SWEEP); developing models to extrapolate the phosphorus load reductions on test plots and pilot watersheds to the entire Lake Erie drainage basin; and collecting and interpreting phosphorus data required for compliance monitoring of municipal and industrial point sources.

Based on this and other data, the Committee evaluates the effectiveness of the Phosphorus Management Plan and reports annually to the COA Board of Review on its status.

The Committee is co-chaired by senior staff members of the Ontario Ministry of the Environment and Environment Canada. There is also representation from Agriculture Canada, the Ontario Ministry of Agriculture and Food and the Ontario Ministry of Natural Resources. Technical support is provided by a sub-committee consisting of five members each from the Ministry of the Environment and Environment Canada.

Public Information Committee

The Public Information Committee promotes better understanding of the Great Lakes environmental issues and of the COA purpose and achievements in addressing these concerns. The Committee arranges public consultation events and materials and informs the Board of Review on the wide spectrum of information released on Great Lakes environmental issues.

The Committee is composed of representatives from the Ontario Ministry of the Environment and Environment Canada (Ontario Region).

SECTION IV: SURVEILLANCE ACTIVITIES

Monitoring the overall health of the Great Lakes aquatic ecosystem is a major function of the Canada-Ontario Agreement. The surveillance program serves to investigate areas of water quality degradation and evaluates the impact of contaminants on the Great Lakes aquatic ecosystem. The program measures the effectiveness of clean-up efforts, warns of emerging problems and tracks down sources of contamination.

These activities fulfill Canada's commitment to Annex 11 of the Canada - United States Great Lakes Water Quality Agreement.

Under COA, surveillance "near shore" is carried out by the Ontario Ministry of the Environment. The ministry monitors discharges, urban and agricultural drainage and the impacts of shore-based construction activities on near shore water quality.

Offshore studies are the responsibility of Environment Canada and the Department of Fisheries and Oceans. These agencies conduct open water surveillance and fisheries research. They assess the state of and trends in overall health of the lakes measuring a variety of physical, chemical and biological parameters.

Activities representative of the provincial and federal agencies surveillance programs are described below.

PROVINCIAL PROGRAMS

Ministry of the Environment surveillance activities were focussed in four areas: basin wide compliance with Agreement objectives; compliance with point source Agreement objectives; remedial action plans; and special projects. A brief summary of activities in each of these areas follows. Information derived from these activities is published in reports by the Ministry of the Environment and in scientific papers listed in the Appendices.

Basin Wide

The province conducts a number of long-term surveillance and monitoring projects to evaluate water quality trends across the Great Lakes Basin:

- Monitoring of *Cladophora* was continued to assess the source and fate of nutrients, heavy metals and organics at selected shoreline sites. Monitoring in 1986 particularly focussed on the St. Clair River in relation to assessment of point source compliance.
- Further assessment of the effectiveness of phosphorus control programs continues through the long-term sampling of raw water from 18 municipal intakes.
- To establish annual nutrient and contaminants loading estimates to the Great Lakes, stratified water quality samples were taken at 17 major tributaries.
- The ministry continued to assess the potential hazard to water quality and biota posed by specific contaminants found in sediments. Information gathered during the 1984/85 field season was used in the assessment.
- The Ontario Ministry of Natural Resources continued in its efforts to measure whole lake responses to pollution and pollution control. This ministry's evaluation is based on the interrelation of fishery data bases with water quality and community structure. Ministry staff also continued to develop criteria which will be used to identify critical fish habitats. The designated habitats will come under surveillance and protection programs.

Special Projects

The province participated in the development of the Upper Great Lakes Connecting Channels (UGLCC) Study. Reports on the following studies were made:

- 1985 sediment and benthic survey of lower St. Marys River-- this study was conducted to assess the effect on the distribution of contaminants of increases in river flow and remedial measures taken at Algoma Steel and St. Marys Paper.
- 1985 sediment and benthic survey of the St. Clair River -- conducted to assess the effectiveness of remedial measures undertaken by industrial dischargers.
- 1983 sediment and benthic survey in Lake St. Clair -- conducted to assess the fate of contaminants in the lake.
- 1984 and 1985 data on contaminants in water and suspended sediments collected from 12 tributaries to the St. Clair and Detroit Rivers -- conducted to assess industrial inputs, particularly during the spring runoff period.
- 1984 St. Clair/Detroit Rivers clam biomonitoring -- conducted to assess the impact of point-source discharges and effectiveness of remedial measures.
- Study of bacteriological conditions in the Detroit River between 1980-84 -- conducted to assess the effectiveness of remedial actions.

- 1985 federal-provincial preliminary sediment investigation in the western basin of Lake Erie -- conducted to update information on the impact of the St. Clair/Detroit Rivers on Lake Erie and to assess the effectiveness of Ontario and Michigan remedial measures.

The ministry also conducted surveys on the loadings of trace organics present in the water and suspended solids of Little River and Turkey Creek.

Compliance with Point-Source Agreement Objectives

To replace the former system of unenforceable guidelines for control of toxic substances, the Ontario Ministry of the Environment initiated the Municipal/Industrial Strategy for Abatement (MISA) program in June of 1986. MISA will provide the regulations to control and reduce the amount of toxic contaminants discharged to Ontario's surface waters. In accordance with Ontario's commitment to the Great Lakes Water Quality Agreement, the ultimate goal of MISA is the virtual elimination of toxic substances.

In support of MISA, the ministry conducted field studies at five pilot sites on the Great Lakes to assess the impact of various discharges on receiving water environments:

- At Thunder Bay, water suspended particulate and sediment quality surveys were conducted to complete the impact assessment of the Great Lakes Forest Products Ltd. effluent discharged via the Kaministiquia River.
- In the St. Marys River, water and sediment were investigated to review effluent requirements for trace contaminants (volatiles, PAHs) associated with discharges from Algoma Steel.
- In the St. Clair River, water, sediment and biota were surveyed to develop the models and understanding of the behaviour of specific chemicals necessary to provide effluent requirements for chlorinated organics and volatile hydrocarbons associated with Dow Chemical discharges.
- In the Toronto waterfront, effluent and receiving water samples were collected in the vicinity of the main sewage treatment plant to evaluate the distribution and extent of toxic contaminants present (drogue tracking provided information on water transport and dispersion in this area of the lake).
- At the Cornwall portion of the St. Lawrence River, two hydrodynamic models were applied to provide river outfalls, to allow for assessment of "best available technology" (BAT) effluent criteria.

In these studies special assessment techniques, such as the use of aquatic organisms as indicators of impacts on water quality, were developed. These assessments of receiving-water impacts will be used to evaluate the effluent limits imposed on dischargers under the MISA program -- specifically whether the "best available technology economically achievable" (BATEA) limits are sufficient for the protection of water quality or whether detailed receiving water studies are required to establish more stringent effluent limits.

Remedial Action Plans (RAPs)

In support of the development of RAPs, the province compiled results from recent surveys conducted in the Areas of Concern. These results will assist the RAP Teams (made up of representatives from the provincial and federal governments) define environmental problems and identify impaired beneficial uses. The following are representative of the activities undertaken in support of the RAP program.

- Intensive field investigations were carried out in Collingwood Harbour (selected for a model RAP) to define cause-effect relationships and to fully describe the environmental concerns identified by the Collingwood draft RAP. Surveys included sampling of water, sediment and biota in receiving waters and source points. The draft RAP was submitted to the International Joint Commission in March 1986.
- Results of ambient investigations conducted in 1984/85 at Marathon, Peninsula Harbour were assessed. The purpose of the study was to define the effectiveness of a submerged diffuser outfall installed by the James River pulp and paper mill in 1984.
- Assessment of the bacteriological surveys conducted at Belleville was completed. The surveys assessed the effectiveness of the sewage treatment plant expansion in 1984 and a new diffuser outfall installed in 1985. Results indicate that the expansion provided little improvement in bacteriological quality under runoff conditions. In the 1985 survey, sources of additional bacteriological degradation in the Bay of Quinte and Moira River were investigated.
- A reduced monitoring program was continued in the Bay of Quinte to assess the long-term effects of municipal phosphorus loading reductions relative to other sources (e.g., phosphorus from sediments). Other sources were examined because phytoplankton densities have recently increased to levels approaching some of the pre-phosphorus control years even though municipal treatment facilities have been improved and phosphorus removal is on-line at all municipal plants.
- Sampling continued at long-term monitoring stations in the Severn Sound area to assess water quality changes resulting from reduced phosphorus loadings and sewage treatment plant expansions in the area. Results have indicated limited response to nutrient control and the potential for eutrophication remains. To better assess the reasons for such limited response ministry staff began to evaluate 1985 current meter data to determine the physical water exchange between Severn Sound and Georgian Bay. Results will aid in the development of a comprehensive Remedial Action Plan for the area.

- Ministry staff collected suspended particulate and caged clam samples near tributary and sewage treatment plant inputs across the central Toronto waterfront and the East Headland. Work in 1986 complemented the 1985 preliminary field investigations. Trace metals, PCBs and organochlorine compounds were the parameters of concern. Analysis of the samples indicated that although the impact of suspended sediment inputs on water quality tends to be localized, the potential exists for impacts on area bottom sediment quality and aquatic biota.
- Modelling efforts were begun to define the conditions under which discharge to the Ganaraska River would impact on the local water intakes at Port Hope Harbour.
- Analysis of surficial bottom sediment and benthic fauna collected in the Cornwall/Massena area during 1985 began to determine the presence and extent of biological impairment and sediment contamination due to industrial and municipal discharges to the St. Lawrence River.
- Electrofishing was conducted by the Ontario Ministry of Natural Resources to obtain information on the resident fish community. These studies indicated that in spite of poor water quality conditions in some locations, the Areas of Concern designated for RAPs all supported fish communities. Some pollution-sensitive species were absent, however, from several areas.

COA Support Programs

In addition to the activities described above, the Ontario Ministry of the Environment conducted a number of non-cost-shared activities under the surveillance program in support of COA and the Canada-United States Agreement. These include: the Regular Tributary Monitoring Program (Annex 11); the Drinking Water Surveillance Program (Annex 11); the Toronto Watershed Management Program (Annex 11); the Sport Fish Contaminant Monitoring Program and Consumption Guidelines (in conjunction with the Ontario Ministry of Natural Resources -- Annex 12); and the Industrial and Municipal Effluent Compliance Monitoring Program (Annex 11 and Article VI 1-c).

FEDERAL PROGRAMS

Federal surveillance activities are conducted by the Inland Waters Directorate - Ontario Region, the Department of Fisheries and Oceans and the Canadian Wildlife Service.

Inland Waters Directorate - Ontario Region

Open Lake Surveillance

The Inland Waters Directorate - Ontario Region (IWD-OR) continued its open lake surveillance program in the Great Lakes. Water samples were taken during cruises on the lakes: one cruise was carried out on Lake Superior, two on Lake Huron and five on Lake Ontario. The samples were subsequently analyzed by the National Water Quality Laboratory to determine if pollutant levels exceeded the objectives stated in the Canada - United States Agreement.

The IWD-OR particularly focussed on trace organic contaminants in this analysis to determine the levels of these substances in the Great Lakes. Sample collection on Lake Erie was the first by IWD-OR since 1975. The United States Environmental Protection Agency has responsibility for sampling Lake Erie. The Lake Ontario Intensive Report was also completed and submitted to the Surveillance Work Group of the International Joint Commission.

The IWD-OR also submitted an update on the status of the water quality of Lake Huron since 1980, ("Lake Huron 1980-85 Review") and data from the surveillance cruise on Lake Superior to the International Joint Commission for inclusion in the 1987 Water Quality Board Report. The Water Quality Board Report forms the basis for the International Joint Commission review and recommendations to governments on the progress achieved in meeting the Canada - United States Agreement.

Interconnecting Channels Water Quality Niagara River

A Niagara River Toxics Management Plan has been established to reduce point and non-point source loadings of persistent toxic substances to the Niagara River by 50% by 1996. Under the plan, water and suspended sediment samples collected at Niagara-on-the-Lake and Fort Erie were analyzed for a variety of metals and organics. The analyses of the samples provided data which was used to determine chemical loadings from Lake Erie and to Lake Ontario.

The monitoring carried out at Niagara-on-the-Lake and Fort Erie involved new automatic samplers and protocols. Using a new liquid-liquid counter current extractor developed by Dr. Peter Goulden of the National Waters Research Institute (NWRI) large volumes of centrifuged water (approximately 50L) were continuously extracted over a 24-hour period on a weekly basis.

At the same time, suspended sediment samples were collected for a 24-hour period each week. The flow through period of the river (approximately 15 hours) was taken into account; samples at Fort Erie are collected 15 hours in advance of those at Niagara-on-the-Lake.

All samples were spiked with surrogate spikes so that field and lab extraction recoveries were known. Some preliminary data from this new sampling protocol have been received for the April-June period. The data suggest that the new protocol provides a more accurate reflection of concentrations in the water. This, in turn, will provide more accurate estimates of loadings.

Two reports on pollution issues in the Niagara River were submitted this year:

- "Recent Trends in Water Quality of the Niagara River" summarized water quality trends observed at the Niagara-on-the-Lake station during the period 1976-83; it was submitted in draft form to the IWD Publications Branch.
- "Estimates of Loadings by Numerical Integration" uses statistical procedures to estimate loadings of materials from the Interconnecting Channels to the Great Lakes; it was prepared by National Waters Research Institute and IWD staff and published by Elsevier in Proceedings of Workshop of Canada Centre for Inland Water (CCIW) in October 1985".

In late 1985, a Niagara River Monitoring Committee was formed to oversee the ambient monitoring portion of the Niagara River Toxics Management Plan. The Committee has three objectives: to assess the degree of compliance with jurisdictional control requirements; to assess trends to determine response to control measures, the effectiveness of those measures and emerging problems; and to identify sources of toxic substances inputs to the Niagara River.

In October, 1986, a sub-group of the committee involved with statistical interpretation tabled a report entitled "A Joint Evaluation of Upstream/Downstream Niagara River Monitoring Data 1984-86". This report, which was accepted by the Niagara River Monitoring Committee, incorporated an earlier report titled "Evidence of Contaminant Loading to the Niagara River between Fort Erie and Niagara-on-the-Lake".

St. Clair River

A detailed report of water quality surveys taken along the St. Clair River was published in the Water Pollution Research Journal of Canada. The surveys showed that industrial effluents containing contaminants such as hexachlorobenzene, hexachlorobutadiene and pentachlorobenzene were confined to the Canadian shoreline, Chenal Ecarte and the South Channel.

This indicates that Canadian industries are the source of these contaminants. Water quality monitoring stations were therefore established at Point Edward and Port Lambton. Measurements were taken at these locations to determine the ambient levels of organic contaminants at the head and lower portion of the St. Clair River. Carried out over several years, these measurements will provide a long term record of water quality in the St. Clair River which can be used for trend assessment.

St. Lawrence River

At Wolfe Island on the St. Lawrence River, an automatic water sampler was used to collect samples for the analysis of nutrients, major ions, trace metals and radioactivity. Analyses of these samples helps to estimate the loadings of chemicals exiting from Lake Ontario.

Results of these analyses are provided annually to the International Joint Commission for inclusion in their Great Lakes Water Quality Report.

Five reports on pollution issues in the St. Lawrence River were submitted during the year:

- "Water Quality at the Inlet to the St. Lawrence River, 1977-83" details changes in water quality at the Wolfe Island station: the report was submitted for publication in the IWD Report Series.
- "Contamination in the Bottom Sediments of the St. Lawrence River in June, 1975" documents levels of bottom sediment contamination: submitted for publication in the IWD Report Series.
- "Evaluation of the Nutrient Forms Measured at Wolfe Island" evaluates sample preservation techniques and their effect on the nutrient data gathered at the Wolfe Island Station.

- "Trace Organic Contaminants in the Bottom and Suspended Sediments of the St. Lawrence River" describes levels of contaminants in bottom and suspended sediments.
- "Organochlorines and Polyaromatic Hydrocarbons in the St. Lawrence River at Wolfe Island": the report was submitted for publication as an IWD Technical Report (No. 144).
- Contributions summarizing eutrophication, toxic chemical loading and trends observed at the Wolfe Island station since 1976 were submitted for inclusion in the Water Quality Board Report.

These reports identify the pollutants present in the St. Lawrence River and indicate whether they pose an existing or potential problem. The information will also be used to develop more effective analysis through modelling.

Atmospheric Loadings

Studies have shown that the atmosphere is a significant contributor of contaminants to water. To determine atmospheric loadings in the Great Lakes Basin, the Water Quality Branch (IWD) continues to operate a network of 16 precipitation stations. The information gained is provided to the International Joint Commission in support of its International Surveillance Plan. A draft report on the monitoring of organic contaminants in atmospheric precipitation was begun in 1986/87.

Other activities from this period that addressed atmospheric loadings included the following:

- Presentation of a paper in conjunction with the United States Environmental Protection Agency titled "Atmospheric Loadings of Total Phosphorus to the Great Lakes: 1982-84"; presented at the National Atmospheric Deposition Program at Atlanta in October.
- Presentation of data to the International Joint Commission sponsored Workshop on Atmospheric Loadings of Toxic Chemicals to the Great Lakes Basin; the workshop was held at Scarborough in September.
- Participation by IWD-OR staff on a number of Lake Task Forces responsible for preparing Surveillance Plans for each of the Great Lakes and Connecting Channels, for the Niagara and St. Lawrence Rivers and for Atmospheric Inputs; these plans were submitted by the Water Quality Board to the International Joint Commission for review and then were submitted to governments for their response.

Department of Fisheries and Oceans

Hamilton Harbour Fisheries Assessment and Rehabilitation

The Department of Fisheries and Oceans completed their assessment of the current and future fisheries habitat requirements for Hamilton Harbour. Preliminary surveys had indicated a reduction in spawning habitat. The assessment showed that this reduction is a result of declining emergent vegetation and submerged macrophytes. The major cause of this decline appears to be water level changes in Lake Ontario.

The information gained in this study will be used in the development of a Remedial Action Plan for Hamilton Harbour.

Lake Trout Reproduction

Despite annual Great Lakes trout stocking rates, which exceed several million fish, and the presence of acceptable habitat, there has been little evidence of natural reproduction by lake trout in Lake Ontario. Department scientists are focussing on the relationship between reproductive failure and testicular constrictions to understand this phenomenon.

Their studies indicate that 10-30 percent more Great Lakes lake trout are affected with testicular constrictions than trout from inland lakes and streams. Contaminants may be affecting the hormones which determine testicular growth.

The Department of Fisheries and Oceans will, therefore, continue studies on the presence of reproductive hormones in normal and affected fish in an attempt to relate physiological and histological responses to potential contaminant stress.

Contaminants Surveillance

The Department of Fisheries and Oceans continued its Great Lakes contaminants monitoring program. The levels of routine OCs, PCBs and trace metals in fish and invertebrates were measured at 12 sites in Canadian waters.

In addition, levels of non-routine compounds (e.g. dioxins, furans and toxaphene) were analyzed in priority sites to establish the environmental significance of these recently identified chemicals. To date, the monitoring program has shown that contaminant burdens in Great Lakes fish has decreased since 1977. A recent upward trend for some compounds has been detected, however, in Lake Ontario trout.

Phytoplankton Monograph

Phytoplankton are the basic food supply for a large part of the fish population. As such, they are a fundamental link in the contaminant cycles in the food chain.

The Department of Fisheries and Oceans, to gain a better understanding of phytoplankton, continued its five year project (initiated in 1985) to produce an authoritative text on the phytoplankton community structure, productivity, physiological ecology and dynamics in the Great Lakes.

To date, analysis of the long term data base for Lake Superior, Lake Huron and Georgian Bay has been completed. This information has been used to incorporate biological assessments into the surveillance programs for the Great Lakes and Connecting Channels.

Bioassessment

A micro-computer based assessment technique has been developed for bioassessment studies. This technique will be used to assess the toxicity and bioavailability to the phytoplankton community of contaminants originating from bottom sediments and suspended particulates. In effect, it will demonstrate the impact of contaminants on the environment. Once impact can be shown, regulations can be implemented.

The techniques were applied in the field at two sites --Toronto Harbour and the St. Clair River.

Other bioassessment techniques, such as Limited Sample Bioassay and the *in situ* Plankton Cage were also applied at the Toronto and St. Clair River sites. The development and application of these techniques has been reported in a summary publication.

Biological Tissue Archive

A significant initiative of the Department of Fisheries and Oceans over the past several years has been the development of a Great Lakes tissue archive. A tissue archive will store tissue samples for an indefinite period. This will allow scientists to perform retrospective analysis -- to analyse samples taken in the past and compare them with recent samples. Retrospective analysis will help in determining trends in contamination. When a "new" contaminant is detected, scientists can determine whether this is a result of improved analytical methods or whether the contaminant has actually only recently been introduced into the system.

The first challenge, in developing the archive, has been to define appropriate collection, preservation and storage conditions which will maintain chlorinated hydrocarbon residues in a stable condition for extended periods in a variety of biological tissues.

Department staff this year began summarizing five separate studies related to processing and storing archive samples. This has led to a number of recommendations for changes in current procedures.

Work has also gone forward on developing a data base program. When completed, the program will contain a history of all samples contained in the archive and will allow rapid retrieval of critical samples for analysis or exchange with other agencies in cooperative studies.

Long-Term Biological Index Monitoring Program

To measure changes in water quality resulting from remedial actions, the Department of Fisheries and Oceans initiated its Bioindex Program on Lake Ontario. The program has obtained baseline information on biota and the chemical and physical environment. From this, several correlation tables have been developed. For example, results are used to determine the response of zooplankton -- another level in the food chain -- to changes in water quality over all seasons.

This year, analysis continued on 1983 and 1984 data bases. Through this analysis, department scientists are attempting to relate water quality changes to productivity in both the benthic invertebrate community and forage fish populations. The results will be published in technical reports and literature papers.

Ultra-trace Analytical Laboratory

Surveillance and research projects require trace and ultra-trace analyses for selected persistent organic contaminants and selected metabolites. These contaminants appear in concentrations as low as parts-per-billion and even parts-per-trillion (this is equal to one second in 30,000 years).

The analyses are provided by the ultra-trace laboratory. During this year, the lab completed analyses to identify the whole fish/fillet ratio of dioxins and dibenzofurans in Lake Ontario salmonids. In addition, the lab participated in collaborative studies with Ontario Ministry of the Environment and the International Joint Commission Data Quality Work Group to determine data compatibility with similar facilities analyzing Great Lakes samples. Further development of the laboratory will include increased automation to improve analytical efficiency.

SECTION V: TOXIC SUBSTANCES STUDIES

The Canada-United States Great Lakes Water Quality Agreement calls for zero discharge and virtual elimination of persistent toxic substances. Present studies indicate that longer term protection is within reach and recovery of a healthy Great Lakes Basin ecosystem is possible.

Long-term biomonitoring programs for substances such as PCB, DDT, chlordane and mercury show dramatic declines in residue levels over the past decade. These data also indicate that the western end of Lake Ontario is the most severely impacted of the Canadian waters of the Great Lakes. Mirex residue levels, for example, continue to be elevated in western Lake Ontario biota. Biological sampling indicates that sources on the Niagara River are the most probable cause of this problem. Efforts will continue to eliminate these discharges.

Levels of contaminants in herring gulls are continuing to decrease. Population levels have risen dramatically and the occurrence of deformities are very low.

The levels of several toxic substances in fish have declined and improvements in species diversity and numbers of organisms in important parts of the ecosystem have been observed.

The occurrence of tumours has been observed in specific species in some parts of the Great Lakes. Fish from other areas of the Great Lakes will be studied to assess the full extent of this problem. Investigations to link the occurrence of tumours to contaminants are underway.

The specific federal and provincial programs for the inventory, assessment, control and research of persistent toxic substances are described below.

Provincial Programs

The Ontario Ministry of the Environment maintains several long term programs which address organic and inorganic contaminant residues in aquatic biological tissues. The testing of fish, aquatic plants and other aquatic organisms offers an excellent means of measuring the distribution of contaminants and of identifying pollution sources. Monitoring of temporal trends helps to evaluate the effectiveness of remedial actions and lake self-purification processes. This monitoring also enables early identification of new substances of potential concern.

The Sports Fish Testing Program was continued in 1986/87. The program is a joint effort by the Ontario Ministries of Environment, Natural Resources and Labour. Staff from these ministries collect various angling and commercial fish species from locations around Lakes Superior, Huron, Erie, Ontario and the connecting channels. The edible tissues are tested for metals (e.g. mercury), pesticides (e.g. DDT, chlordane, toxaphene) and industrial organics (e.g. PCB, mirex). Additional substances, such as chlorinated benzenes, are routinely added to the program when analytical techniques have been evaluated. One result of the program is the consumption guidelines provided in the "Guide to Eating Ontario Sport Fish" which is available free of charge throughout Ontario. These guidelines apply to 183 sampling locations around the Great Lakes as well as 1200 inland lake and river locations.

The Ontario Ministry of the Environment's Juvenile Fish Testing Program also involves routine annual collection of fish from the Canadian near-shore areas of the Great Lakes and connecting channels. In this program, young-of-the-year spottail shiners are collected and tested for the same range of organic and inorganic toxic substances as in the Sport Fish Program. In the Great Lakes, emphasis is placed on testing for industrial organics and pesticides.

Juvenile fish offer a unique advantage for measuring contaminant spatial distribution and temporal trends on a year-to-year basis because their exposure period (about four months) and area of exposure (within one or two kilometers of the place they were hatched) are easily determined. These features also make juvenile fish excellent indicators of specific sources of pollution.

The Ontario Ministry of the Environment continued its monitoring program for metals and PCBs along Canadian shorelines using the filamentous alga *cladophora*. The program complements the studies using fish. Together, alga and fish monitoring provides data which reflect the biological availability of the toxic substances. It also improves the detectability of toxic substances as these substances are bioconcentrated and bioaccumulated in the fish and alga.

Federal Programs

The Canadian Wildlife Service (CWS) continued the assessment of long term and geographic trends in toxic substances in wildlife. CWS staff collected herring gull eggs from 16 sites throughout the Great Lakes.

The food sources of ducks and/or fish were also sampled near Walpole (Lake St. Clair) and Hamilton Harbour. Levels of contaminants in wildlife near Walpole Island are generally low, although PCB concentrations in some ducks indicate more study is required.

Duck mortalities were slightly elevated in populations from Hamilton Harbour and the Detroit River as compared to other areas of the Great Lakes. (Lead levels in test ducks found in Hamilton Harbour are high enough to be a contributing factor to their deaths.)

The Department of Fisheries and Oceans monitored white suckers from Lake Ontario for tumours. (The study revealed that these fish had several types of pathological abnormalities.) Spinal deformities, external lesions and a number of types of liver lesions were observed. In comparison to fish from a relatively unpolluted site in northern Lake Huron, Lake Ontario fish had a higher evidence of lesions, particularly hepatocellular (liver) carcinomas.

SECTION VI: POLLUTION CONTROL REPORTS

Information on pollution control measures and achievements were published in two Ontario Ministry of the Environment reports: The 1986 Sewage Treatment Plant Discharges Report; and The 1986 Industrial Discharges Report.

Sewage Treatment Plant Discharges Report

The 1986 report shows improvement in sewage treatment plants (STPs) performance over 1985.

Seventeen percent (66 of 385) of the STPs that reported failed to meet annual effluent requirements for at least one of three provincial guidelines: phosphorus, suspended solids and biological oxygen demand. This compares with the 26 percent (99 of 383) of STPs out of compliance in 1985.

Phosphorus loadings are also compiled on a monthly basis for the 258 STPs discharging into the Great Lakes Basin. In 1986, 49 percent or 126 were out of compliance in one or more months, compared to 53 percent in 1985.

Of the 126 plants out of compliance, 48 have remedial programs scheduled for completion in 1987. Twenty-three have compliance programs scheduled for completion after 1987 and 24 require further study or funding to establish a compliance schedule.

Two programs have been enacted to help municipalities upgrade and expand STPs so as to protect Ontario's waterways. Direct grants for sewage works were increased: municipalities with populations greater than 7,500 seeking to redress pollution problems are now eligible for 33 percent provincial funding. Previously, the province paid 15 percent.

The Lifelines program offers assistance to municipalities to rehabilitate deteriorating sewer lines which can contribute to pollution by overloading sewage systems. The province now provides 50 percent of the cost of studies to pinpoint problems and 33 percent of the cost of the rehabilitation work.

Industrial Discharges Report

The 1986 report on industrial discharges showed no improvement over 1985.

The report indicated that 101 out of 154 industrial dischargers did not meet ministry requirements during one or more months of 1986. In 1985, 98 of 147 sources monitored exceeded ministry limits during one or more months.

Seventeen of the 101 dischargers that failed to meet monthly levels are under Control Orders requiring improvements. Eighteen others are currently instituting controls voluntarily. The ministry initiated eight prosecutions against dischargers included in the 1986 report.

Ministry requirements for 1986 cover a limited number of contaminants such as suspended solids, pH, biochemical oxygen demand, phenolics, oil and grease, heavy metals, ammonia and cyanide.

Most of the ministry requirements are in the form of unenforceable guidelines. This system is in the process of being replaced by a group of legally enforceable regulations under the Municipal/Industrial Strategy for Abatement (MISA) program.

SECTION VII: POLLUTED SEDIMENT STUDIES

The major activities undertaken in 1986-87 were in support of in-place pollutants assessment techniques and Remedial Action Plans (RAPs).

As part of the In-Place Pollutants Program, the Ontario Ministry of the Environment prepared several reports:

- A Program Overview - Volume 1
- Background and Theoretical Concepts - Volume II
- Phase I Studies - Volume III

Collingwood and Wheatley Harbours were selected as pilot sites for testing the in-place pollutants assessment techniques. In Collingwood Harbour, a comprehensive study was not completed because navigational dredging, which took place during the study, removed material to a confined disposal facility. Results that were obtained will be submitted to the Collingwood Remedial Action Plan Team to be incorporated into their RAP Report. Environment Canada and the Ontario Ministry of the Environment Regional Office have initiated an ongoing study in Wheatley Harbour. Study results will be submitted to the Wheatley Harbour RAP team.

The proposed work for 1987/88 includes:

Development of Chemical Criteria

- Phase I - Strategy Development: a literature and database review will be conducted to identify the strategies and options to be used in the development of numerical, contaminant-specific sediment quality objectives.
- Phase II - Assignment of Numerical Criteria: specific numbers will be assigned to individual contaminants using the strategy developed in Phase I. At present, guidelines exist for 30 parameters. Guidelines for additional chemical parameters will be developed on an ongoing basis.
- Federal and provincial scientists will continue in field and laboratory studies to address information gaps and will provide direct assistance to RAP teams on request until guidelines are in place.

Development of Sediment Bioassays

The greatest information gap exists in the area of laboratory and field bioassays for detailed sediment evaluation. This detailed evaluation is a critical step in the RAP process prior to determining the need for remedial action. Ongoing work by the National Waters Research Institute (NWRI) and the Ontario Ministry of the Environment will provide much of the database that will be required to develop detailed evaluation procedures.

Development of Assessment Techniques for Upland and Confined Disposal Facilities

In order to determine what precautions must be taken when managing upland and confined disposal facilities, the National Waters Research Institute will be conducting a two year study that examines contaminant uptake by vegetation.

SECTION VIII: ENVIRONMENTAL MONITORING AND MODELLING ACTIVITIES

The purpose of environmental monitoring and modelling is to assess the effectiveness of those federal-provincial programs designed to reduce phosphorus loadings in the Great Lakes.

This requires, first, surveillance and monitoring of point source discharges to measure progress in reducing phosphorus loadings. Then, for non-point sources, an inventory must be developed which will identify land use practices that reduce soil erosion and hence phosphorus input.

Two major tasks evolve from this purpose: tributary load monitoring and agricultural non-point source load monitoring.

Tributary Load Monitoring

Although data does exist on tributary phosphorus loadings, further study is required to assess the accuracy of the information and thus, minimize errors in identifying future needs. Currently a number of projects are underway to assist in that evaluation. One example is the "Evaluation of the Phosphorus Data Base" project. Here, the methods used to calculate phosphorus loadings are being reviewed to clarify how the information gained by these methods should be applied when evaluating future trends.

Agricultural Non-point Source Programs

The intent of the Soil And Water Quality Enhancement Program (SWEEP) is to actively promote a soil management program which will reduce phosphorus runoff loss by 0.5 kg/ha from 400,000 ha. of agricultural land. This is expected to result in 200 tonnes per year phosphorus loading reductions to the Lake Erie Basin.

Under SWEEP, several pilot watershed studies will be conducted to measure runoff from agricultural land. All basic equipment was purchased for installation of flow and water quality monitoring stations in the pilot watersheds. Criteria for selecting hydrometric sites were developed and will be used in selecting watersheds. Approval by environmental agencies is required before the selection of watersheds is finalized and arrangements made with local farmers.

Currently, various agricultural conservation practices are employed. A Modelling Task Force was created to determine the effectiveness of these practices if implemented on a wide scale.

The Task Force reviewed various modelling approaches and identified the data those approaches must generate to determine phosphorus reductions. They concluded that monitoring specific practices under a variety of conditions, with consideration of the extent of their use, would be the most suitable method of demonstrating phosphorus reductions to the Lake Erie Basin. A list of the most practicable agricultural practices was prepared and, based on experience, the most popular are conservation tillage and cropping.

Field data collection for pre-implementation of practices was nearly completed and will be followed up with similar surveys to assess the extent of adoption.

Two research proposals, "Phosphorus Flux vs Soil Erosion vs Conservation Practices" and "Relationship between Sub-surface Infiltration/Transport of Phosphorus and Surface Runoff of Phosphorus Under Soil Conservation Practices on Ontario Soils" have been endorsed and arrangements for undertaking the work are currently being explored.

Finally, a project was initiated to identify and catalogue all relevant basin studies and watershed surveys in Ontario. The catalogue will be useful in assessing impacts from agricultural runoff.

SECTION IX: PUBLIC INFORMATION ACTIVITIES

In 1986/87 work began on the development of Public Involvement Guidelines. These guidelines will be used by Remedial Action Plan teams in developing the Remedial Action Plans and the production of a brochure outlining the RAP process.

A communications plan for the Niagara Toxics Committee was also developed jointly with the United States Environmental Protection Agency.

SECTION X: BUDGET

Funds expended under the 1985 COA derive from two sources: Article VII of the Agreement and Section 4 of Schedule G, "Sewerage Facilities Construction Program".

Funds Available from Article VII

These funds support the cost-shared activities of Canada and Ontario under the Agreement and were applied as follows:

Activity	Total	Cost to each party
Public Information	\$100,000	\$ 50,000
Surveillance	3,100,000	1,550,000
Implementation of the Canadian Federal/Provincial Phosphorus Management Plan	<u>221,000</u>	<u>110,500</u>
	\$3,421,000	\$1,710,500

Section 4, Schedule G, Sewerage Construction Program

This is the continuation of the program initiated in 1982 which provides a one time Federal contribution to the Province of \$65,000,000 to complete municipal sewerage construction projects in accordance with the Canada - United States Great Lakes Water Quality Agreement. Contributions available to the Province for transfer to eligible municipalities in fiscal year 1986-87 amounted to \$4,583,115. This leaves an unspent balance of \$2,082,254 from the amount available.

Appendix 1

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Collingwood Harbour RAP; Presentation to Great Lakes Institute at Detroit Summit on the Great Lakes, November 1986, Detroit, Michigan. Simpson, K. (1986).

"Biological Monitoring". Paper presented at the International Symposium on Toxics in the Niagara: A Shared Challenge, February 3-6, 1987, Toronto, Ontario. Kauss, P.C. (1987).

St. Clair MISA Pilot Site - New Approach to Cause & Effect. Presented at Eleventh Annual Water Resources Seminar, February 26, 1987, Kempenfeldt Bay, Ontario. Nettleton, P.C. (1987).

Sediment Quality in the Toronto Waterfront; Presented at the Institute for Environmental Studies, University of Toronto, March 24, 1987. Boyd, D. (1987).

Appendix 3

1986-87 Canada-Ontario Great Lakes Surveillance Program Province of Ontario

Project

Ontario Ministry of the Environment

Thunder Bay Remedial Action Plan (RAP)
Thunder Bay Nearshore Survey
Nipigon Bay Remedial Action Plan (RAP)
Jackfish Bay Remedial Action Plan (RAP)
Peninsula Harbour Remedial Action Plan (RAP)
Peninsula Harbour Environmental Survey
St. Marys River MISA
Spanish River Remedial Action Plan (RAP)
Penetang-Midland Remedial Action Plan (RAP)
Penetang-Midland-Sturgeon Bay Environmental Monitoring
Severn Sound-Georgian Bay Physical Exchange
Collingwood Harbour Remedial Action Plan (RAP)
 (a) Water Quality Study
 (b) Surficial Sediment Study
 (c) Physical Study
 (d) Assessment of Inplace Pollutants
 (e) Municipal Sources Identification
 (f) Tributary Monitoring
St. Clair River MISA
Lake St. Clair Sediment and Benthos
Detroit River Bacteriological Studies
Contaminants Inputs to St. Clair, Lake St. Clair and Detroit Rivers
St. Clair and Detroit River Biomonitoring
Western Basin - Lake Erie
Wheatley Harbour Remedial Action Plan (RAP)
Niagara River Remedial Action Plan (RAP)
St. Catharines Bacteriological Study
St. Catharines Physical Circulation
Hamilton Harbour Remedial Action Plan (RAP)
Toronto Remedial Action Plan (RAP)
Toronto Main Sewage Treatment Plant - MISA
Toronto Waterfront
 (a) Inventory and Assessment of Contaminants Associated with
 Suspended Particulates
 (b) Macro Circulation Model
 (c) Bacterial Loadings
Port Hope Remedial Action Plan (RAP)
Port Hope Physical Circulation and Impact Assessment

Project

Bay of Quinte Remedial Action Plan (RAP)
Bay of Quinte Study ("Project Quinte")
Bay of Quinte - Inorganic and Organic Compounds
Belleville: Bacteriological Status following Sewage Treatment Plant Expansion
Kingston Harbour Bacteriological Survey
St. Lawrence River Remedial Action Plan (RAP)
St. Lawrence River - Maitland
St. Lawrence River - Cornwall/Massena Area
Environmental Impacts of Inplace Pollutants in Sediments
Development of Sediment Guidelines and Protocol: Part A
Part B
Part C
Development and Standardization of Sediment Bioassessment Techniques
Nearshore Young-of-the-Year Fish Contaminants Surveillance
Nearshore *Cladophora* Contaminants Monitoring
Water Works Intake Monitoring Program
Enhanced Tributary Monitoring

Ontario Ministry of Natural Resources

Analysis, Evaluation and Integration of Data Bases
Inventory and Evaluation of Fish Habitat in Great Lakes
Critical Fish Habitats in Areas of Concern

Appendix 4

Environment Canada Publications and Presentations Inland Waters/Lands Directorate - Ontario Region

- Biberhofer, J. and R.J.J. Stevens, "Organochlorine Contaminants in the Ambient Waters of Lake Ontario": Submitted to IW/LD Publications. Burlington, 1986.
- Chan, C.H. and J. Kohli, "Trace Contaminant Surveys in the St. Clair River". Submitted to IW/LD Publications. Burlington, 1986.
- Chan, C.H. Y.L. Law and B.G. Oliver, "Measured and Modelled Chlorinated Contaminant Distributions in the St. Clair River". Water Poll. Res. Jour. Can., Vol. 21, No. 3, 1986.
- Chan, C.H. and L.H. Perkins, "A Comparison of Bulk and Wet Deposition at Woodbridge, Ontario. 1979-1981". Submitted to IW/LD Publications. Burlington, 1986.
- El-Shaarawi, A.H., K.U. Kuntz and A. Sylvestre, "Estimation of Loading by Numerical integration". In: Statistical Aspects of Water Quality Monitoring, A. H. El-Shaarawi and R.E. Kwiatkowski, eds. Developments in Water Series, Vol. 27. Elsevier Publ. Amsterdam, 1986.
- Klappenbach, E.W. and C.R. Chan, "Atmospheric Loadings of Total Phosphorus to the Great Lakes, 1982-1984". Presented at the Annual Meeting of National Atmospheric Deposition Program, Atlanta. October, 1986.
- Kuntz, K.W., "Contaminants in Bottom Sediments of the St. Lawrence River in June 1975". Submitted to IW/LD Publications. Burlington, 1986.
- Kuntz, K.W., "Input and Output Loadings of the Niagara River during 1984". Unpublished Report. Burlington, 1986.
- Kuntz, K.W., "Recent Trends in Water Quality of the Niagara River". Submitted to IW/LD Publications. Burlington, 1986.
- Kuntz, K.W., J. Biberhofer, S.M. Metikosh, and N.D. Warry, "Sampling Protocol for the Niagara River". Accepted by the Niagara River Monitoring Committee. 1986.
- McCrea, R.C., "Continuous Field Sampling for Analysis of Toxic Compounds in WQB-OR". Abstract in Proceedings of Inland Waters Directorate Instrumentation Workshop 1986, May 13-14, 1986.
- Merriman, J.C., "Trace Organic Contaminants in the Sediments of the International Section of the St. Lawrence River". Submitted to IW/LD publications. Burlington, 1986.
- Metikosh, S. and J.O. Nriagu, "Sampling and Analytical Protocols for Trace Metals in Open Waters of the Great Lakes". Submitted to the Surveillance Work Group. February, 1986.

Neilson, M.A., "Lake Superior 1985 Status Report". Unpublished Report submitted to Lake Superior Task Force. Burlington, 1986.

Neilson, M.A. and R.J.J Stevens, "Determination of Water Quality Zonation in Lake Ontario using Multivariate Techniques". In: Statistical Aspects of Water Quality Monitoring, A.H. El-Shaarawi and R.E. Kwiatkowski, eds. Developments in Water Series, Vol. 27. Elsevier Publ. Amsterdam, 1986.

Neilson, M.A., R.J.J Stevens, "Spatial Heterogeneity in Lake Ontario". Accepted in Can. J. Fish Aquat. Sci., 1986.

Neilson, M.A., R. J. J Stevens and J. Biberhofer "Organochlorines, PCBs and Chlorobenzenes in Centrifuged Lake Huron Water Samples", Unpublished Report Submitted to Lake Huron Task Force, 1986.

Neilson, M.A., R.J.J. Stevens, J. Biberhofer. P.D. Goulden and D.H.J. Anthony, "A Large Sample Extractor for Determining Organics in the Great Lakes". Submitted to IW/LD Publications. Burlington, 1986.

Neilson, M.A., A. Sylvestre and S.M. Metikosh, "Lake Huron 1980-1985 Review". Unpublished Report submitted to Lake Huron Task Force, 1986.

Stevens, R.J.J. and M.A. Neilson. "Response of Lake Ontario to Reductions in Phosphorus Load". Accepted in Can. J. Fish. Aquat. Sci. 1986.

Sylvestre, A.. "Organochlorines and Polyaromatic Hydrocarbons in the St. Lawrence River at Wolfe Island". Submitted to IW/LD Publications. Burlington, 1986.

Sylvestre, A.. K.W. Kuntz and N.D. Warry, "Water Quality at the Inlet to the St. Lawrence River. 1977 to 1983". Submitted to IW/LD Publications. Burlington, 1986.

Warry, N.D., K.U. Kuntz and J. Biberhofer. "Evidence of Contaminant Loading to the Niagara River between Fort Erie and Niagara-on-the-Lake". Accepted by Group C of Niagara River Monitoring Committee 1986.

Appendix 5

Department of Fisheries and Oceans (GLLFAS) Publications, Reports & Presentations Related to the activities of the COA Surveillance Committee

Publications

- Johannsson, Ora E. , and C.K. Minns. (in press). "Examination of association indices and formulation of a composite seasonal dissimilarity index". *Hydrobiologia*.
- Johannsson, Ora E. (submitted.) "A comparison of Lake Ontario zooplankton communities between 1967 and 1985: Before and after implementation of salmonid stocking and phosphorous control". J. Great Lakes Res.
- Munawar, M., 1986. "Algal fractionation bioassay (AFB) for sediment toxicity and bioavailability". In: Guidance on Characterization of Toxic Substances Problems in Areas of Concern in the Great Lakes Basin. International Joint Commission. Windsor , Ontario
- Munawar M. and I.F. Munawar, 1986. "Seasonality of phytoplankton in North American Great Lakes: A comparative synthesis". In: M. Munawar and J F. Talling (Eds.), Seasonality of Freshwater Phytoplankton: A Global Perspective. *Dev. Hydrobiol.* 33:85-115.
- Munawar, M. and J F. Talling, 1986. "The seasonality of freshwater phytoplankton: A global perspective". Preface, *Dev. Hydrobiol.* 33:v-vi.
- Munawar, M. and I.F. Munawar, 1987. "Phytoplankton bioassays for evaluating toxicity of in situ sediment contaminants". *Dev. Hydrobiol.* 149:87-105.
- Munawar, M., R.L. Thomas, W.P. Norwood, and S.A. Daniels, 1986. "Sediment toxicity and production-biomass relationships of size-fractioned phytoplankton during on-site simulated dredging experiments in a contaminated pond". In: "Sediments and Water Interactions". 407-426. Springer-Verlag. New York.
- Sprules, W.G. and M. Munawar, 1986. "Size spectra in relation to ecosystem productivity, size, and perturbation". Can. J. Fish. Aquat. Sci. 43:1789-1794.

Reports

- Hyatt, W.H., J.D. Fitzsimons, M.J. Keir and D.M. Whittle. 1986. "Biological tissue archive studies". Can. Tech. Rep. Fish Aquat. Sci. 1497. pp i-iv, 1-58.
- Hyatt, W.H., 1986. A compendium of field methods used by the Great Lakes Fisheries Research Branch for the Surveillance Work Group of the Great Lakes Water Quality Board, International Joint Commission.
- Whittle, D.M., 1987. Trends in Contaminant Burdens of Lake Erie Fish - (1977-1985). Report submitted to International Joint Commission Surveillance Workgroup, Lake Erie Task Force, January 1987.
- Whittle, D.M., 1986. Lake Ontario Contaminant Trends: Fish and Other Aquatic Biota. Report to Lake Ontario Task Force of International Joint Commission Surveillance Workgroups. December 1986.

Presentations

- Cairns, V.W. , and C. Portt. Factors Uniting Fisheries Rehabilitation in Hamilton Harbour. Presented to the Hamilton Harbour Remedial Action Plan Stakeholders Committee. December 1986.
- Cairns V. W. and C. Portt. The Fisheries Resources of Hamilton Harbour. Presented to the Hamilton Harbour Remedial Action Plan Stakeholders Committee. July 1986.
- Fitzsimons, J. D. , V. W. Cairns, and L.W. Crim. Presence of a testicular anomaly in lake trout and its implications to reproductive function. Presented at the 29th Conference of the International Association for Great Lakes Research, May 26-29, 1986 Scarborough, Ontario.
- Hodson, P.V. 1986. Biochemical monitoring of chemical effects on fish. Presentation at Department of the Environment/Water Quality Board Biological Monitoring Workshop, Burlington, November 19-20, 1986.
- Johannsson, Ora E. The development and application of a composite, seasonal dissimilarity index using Lake Ontario phytoplankton data. Canada Centre for Inland Water. Chemistry-Biology Seminar Series, Burlington, Ont., March 25, 1986.
- Johannsson, Ora E., C.K. Minns. Formulation and use of a composite seasonal dissimilarity index. Inter. Assoc. Great Lakes Res. 29th Conference, Scarborough, Ont., May 26-29, 1986.
- Johannsson, Ora E. Biological Monitoring: The Lake Ontario Experience. International Joint Commission Surveillance Work Group, Windsor, Ont., June 26, 1986.
- Johannsson, Ore E. Open-water zooplankton dynamics: Production and food for fish. PILOR Workshop, Oswego, New York, August 5-7, 1986
- Johannsson, Ora E. Structure and function of the Lake Ontario zooplankton community. McMaster University. February 16, 1987.

- Johannsson, Ora E. History and Function of the Lake Ontario Zooplankton Community. International Joint Commission sponsored Food Web II Workshop, Canada Centre for Inland Waters, Burlington, Ontario, February 25, 1987.
- Johannsson, Ora E. The Long Term Biological Monitoring Program on Lake Ontario Freshwater Institute, Winnipeg, Manitoba, March 10, 1987
- Johannsson, Ora E. Ecosystem Monitoring: The Great Lakes Experience. Biomonitoring Workshop sponsored by the Department of the Environment, Freshwater Institute, Winnipeg, Manitoba, March 11, 1987.
- Munawar, M. and S.A. Daniels. Resin treatment for segregating sediment-bound organic and metal toxicity to ultraplankton. Poster presentation at the symposium on Environmental Insult and Recovery of Stressed Systems. Sponsored by the American Society/Canadian Society of Microbiologists. University of Toronto, June, 1986.
- Munawar, M., C. I. Mayfield and J. Torrie. Application of a microcomputer-based video analysis system to toxicological research. Poster presentation at the International Association of Great Lakes Research meeting. University of Toronto. May 26-29 1986.
- Munawar, M., P.T.S. Wong, and G.Y. Rhee. The effects of contaminants on algae: An overview. An invited presentation at the World Conference on Large Lakes, Mackinac, Michigan. May 18-21, 1986
- Munawar, M. 1986. Algal Fractionation Bioassays and their use for Evaluation of Sediment Toxicity Presentation to Department of Environment/Water Quality Board Biological Monitoring Workshop, Burlington, November 19-20, 1986.
- Munawar, M. Toxicological-ecological research with Great Lakes phytoplankton: An overview. Lecture presented at the Soil and Plant Research Station, Ministry of Agriculture and Fisheries. Hamilton, New Zealand. February, 1987.
- Munawar, M., D. Gregor, S.A. Daniels, and W.P. Norwood. A sensitive screening bioassay technique for the assessment of small quantities of contaminated bottom or suspended sediments. Proc. 4th Internat. Symp. Sed. Water Interactions, Melbourne, Australia. February, 1987.
- Munawar, M., I.F. Munawar, and L.H. McCarthy. Seasonal succession of phytoplankton size assemblages and its ecological implications in the North American Great Lakes. Invited presentation at the International Limnological Congress. Hamilton, New Zealand. February, 1987.
- Munawar, M. and R.L. Thomas. Phytoplankton bioassays from two areas of concern in the North American Great Lakes: Toronto, Ontario and Toledo, Ohio Harbours. Presented at the 4th Internat. Symp. Sed. Water Interactions. Melbourne, Australia. February, 1987.
- Severn, S.R., M. Munawar, and C. I. Mayfield. Effects of sediment-elutriate material on the growth and activity of picoplankton from Lake Ontario. Proc. 4th Internat. Symp. Sed. Water Interactions, Melbourne, Australia. February, 1987.

Munawar, M., I F. Munawar, and L.H. McCarthy. Phytoplankton community structural changes and their response to nutrients and contaminants. Presentation at International Joint Commission sponsored Food Web II Workshop. Burlington, Ontario. February, 1987.

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Thomas, R.L., D.J. Williams, D.M. Whittle, J.E. Gannon & J.H. Hartig. 1986. Contaminants in Lake Ontario - a Case Study. Presentation at the World Conference on Large Lakes, Mackinac Michigan, May 18 - 21, 1986.

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